



# Precision Navigation

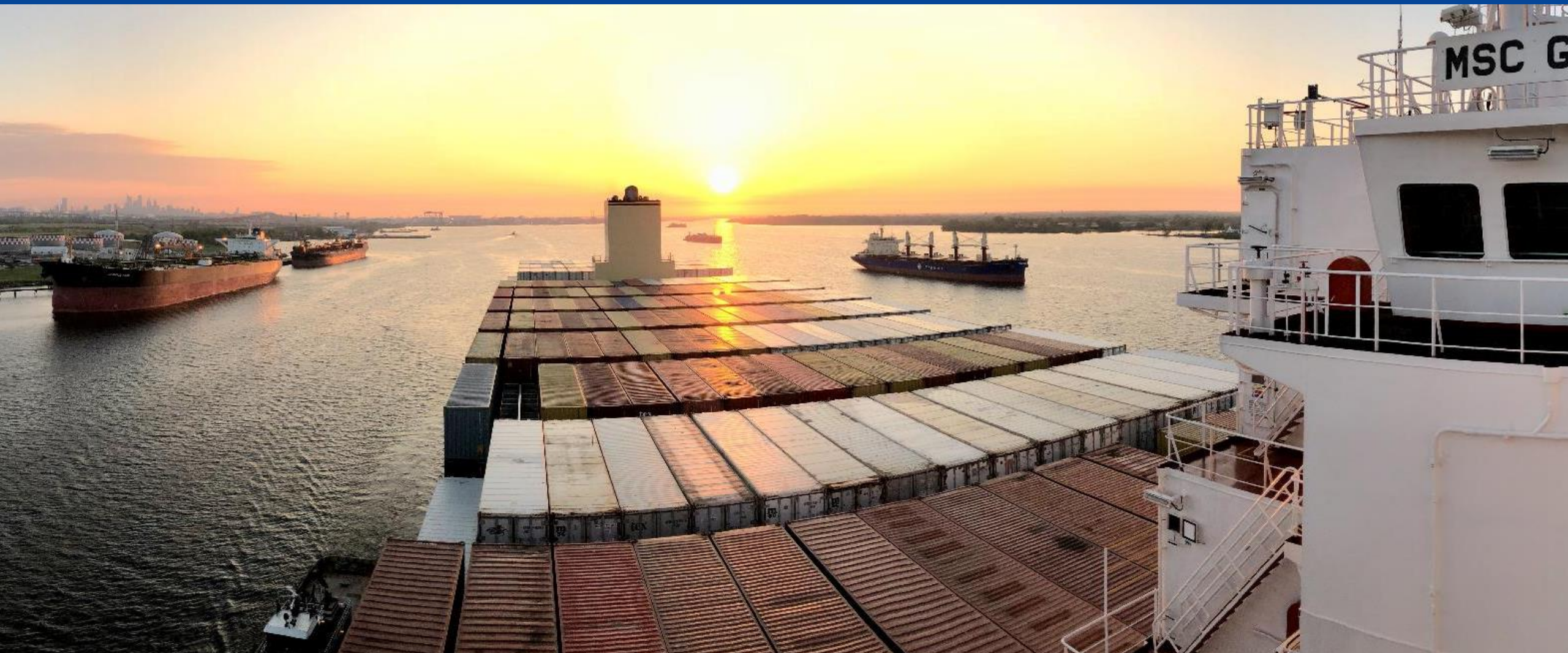
Captain Liz Kretovic, NOAA  
August 13, 2019



Office of Coast Survey  
National Oceanic and Atmospheric Administration



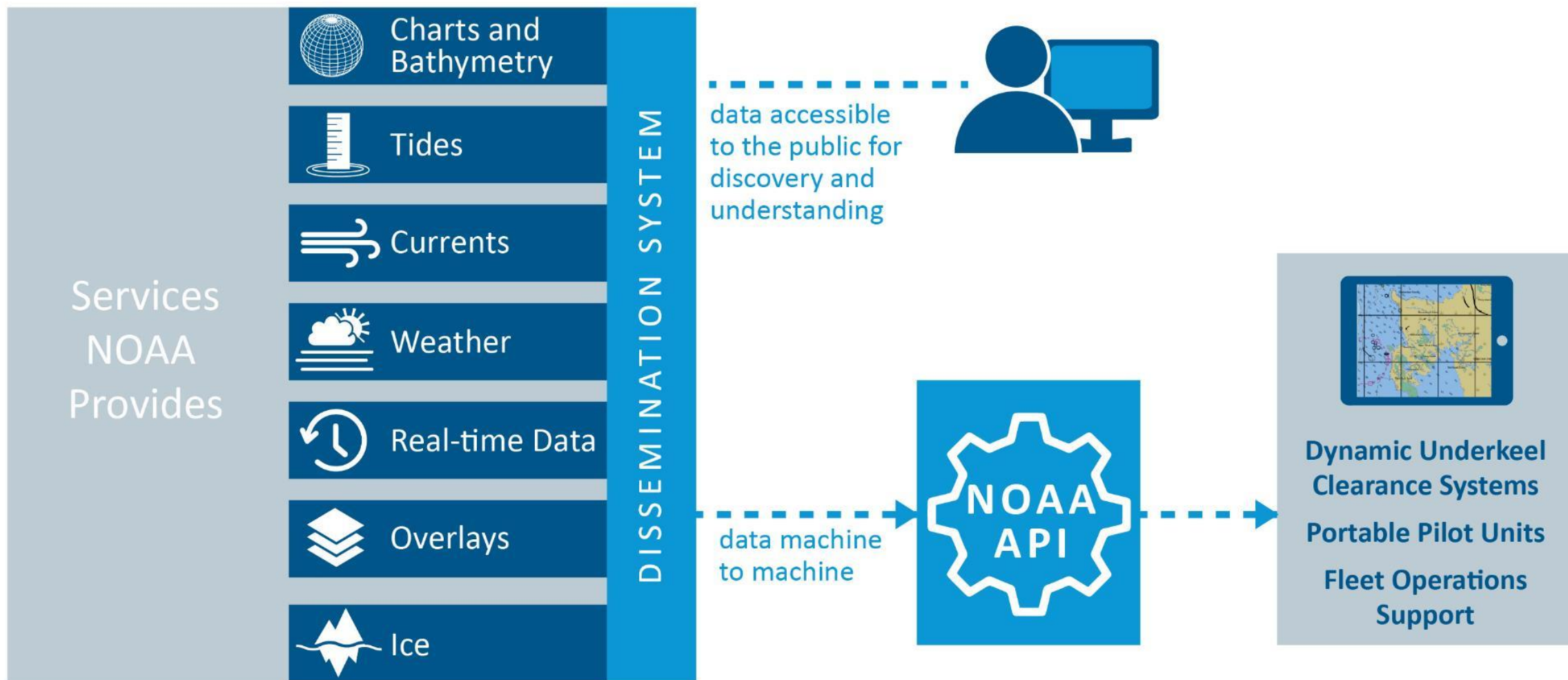
# What is Precision Navigation?



Office of Coast Survey  
National Oceanic and Atmospheric Administration

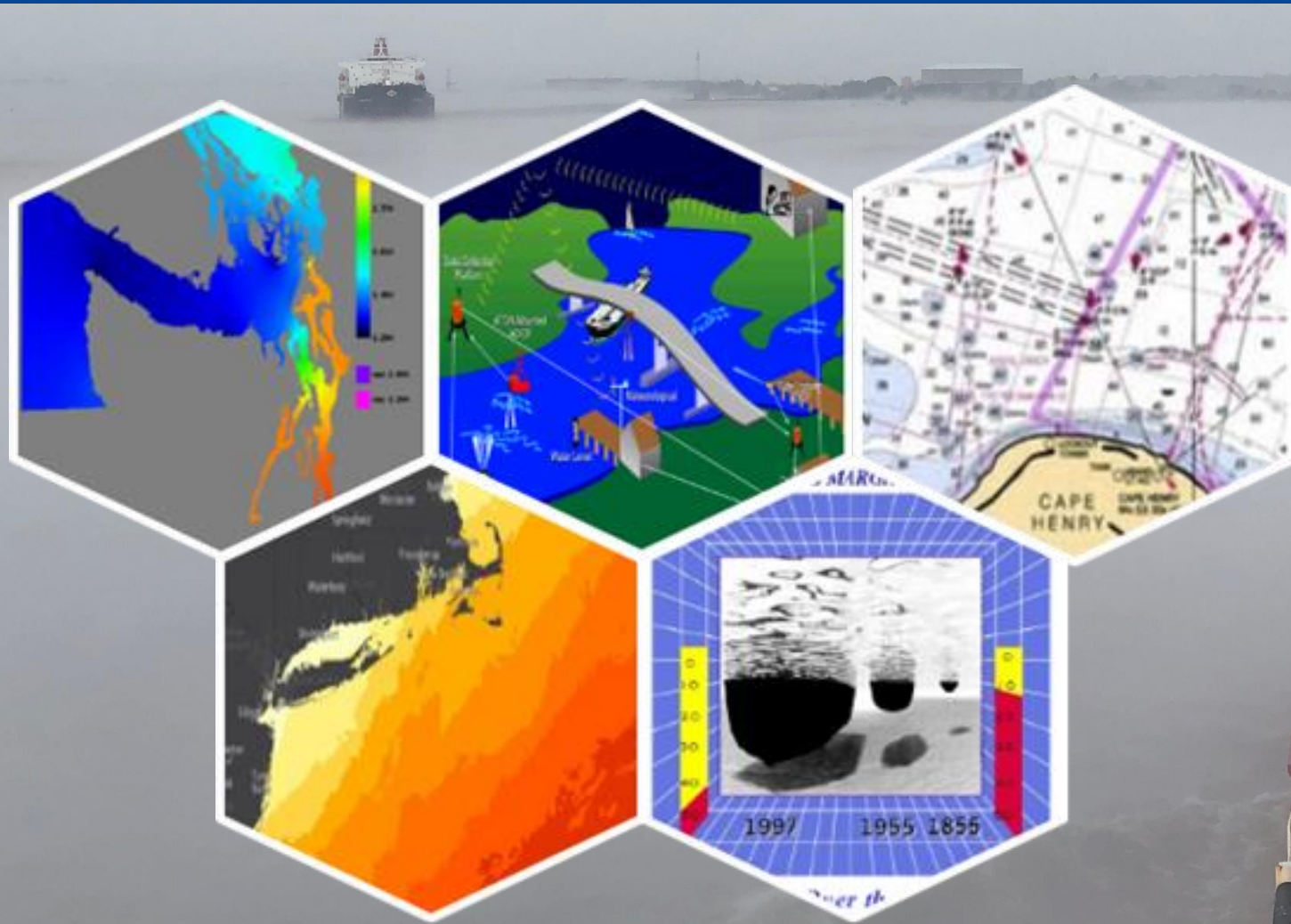


# Precision Navigation Program





# Integrated NOAA Data



Office of Coast Survey  
National Oceanic and Atmospheric Administration



# International Standards





# Precision Navigation Program Projects

Topographic map showing a coastal area. A green polygon is overlaid on the map, and an orange hatched area is visible below it. The map includes contour lines, a blue water body, and various labels such as "bn 1", "bn F", "bn 8", "71", and "Nr 2". A red dotted line runs diagonally across the map. A scale bar at the bottom left indicates a scale of 1:4400 (Overscale x1.3). The top left corner shows "Verizon LTE" and the top right corner shows "3:32 PM".

## An aerial photograph of a wide river. On the left bank, there is a large industrial facility with several large circular tanks and buildings. A bridge spans the river in the middle ground. On the right bank, there is another industrial area with more circular tanks and structures. A red dot is placed in the river, with a red arrow pointing to it from the label 'W13188 DiaN 01'.

The map shows the Hudson River flowing into the Atlantic Ocean. Key bridges labeled include the George Washington Bridge, Brooklyn Bridge, Verrazano-Narrows Bridge, Bayonne Bridge, Arthur Kill Railroad Bridge, Victory Bridge, and Newark Bay Bridge. Major highways shown are I-80, I-95, I-278, I-280, I-678, I-19, I-27, and I-26. The map also shows the locations of New York City and New Jersey. A scale bar indicates a distance of 0 to 4 miles.



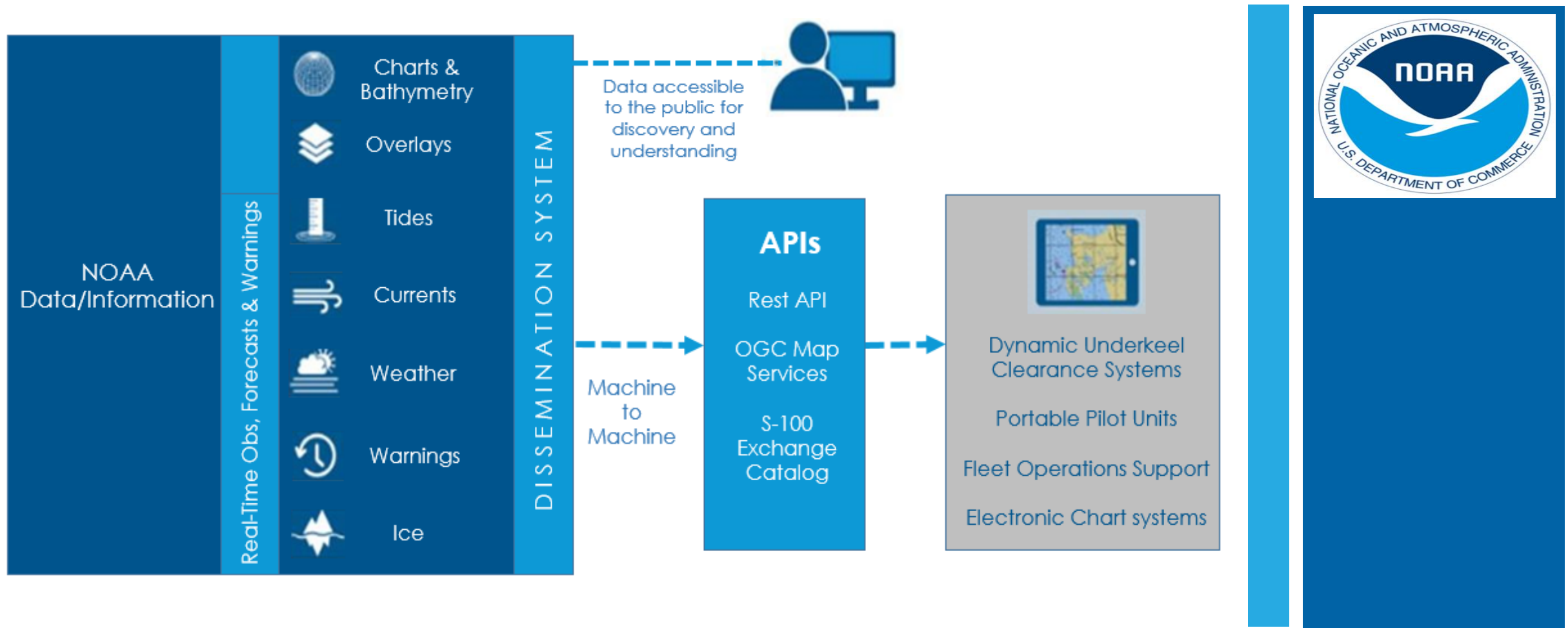




Questions?







# Building a NOAA Precision Navigation Dissemination System

NOAA Precision Navigation Workshop

*John Kelley, Jason Greenlaw, Erin Nagel, & Adam Gibbons*

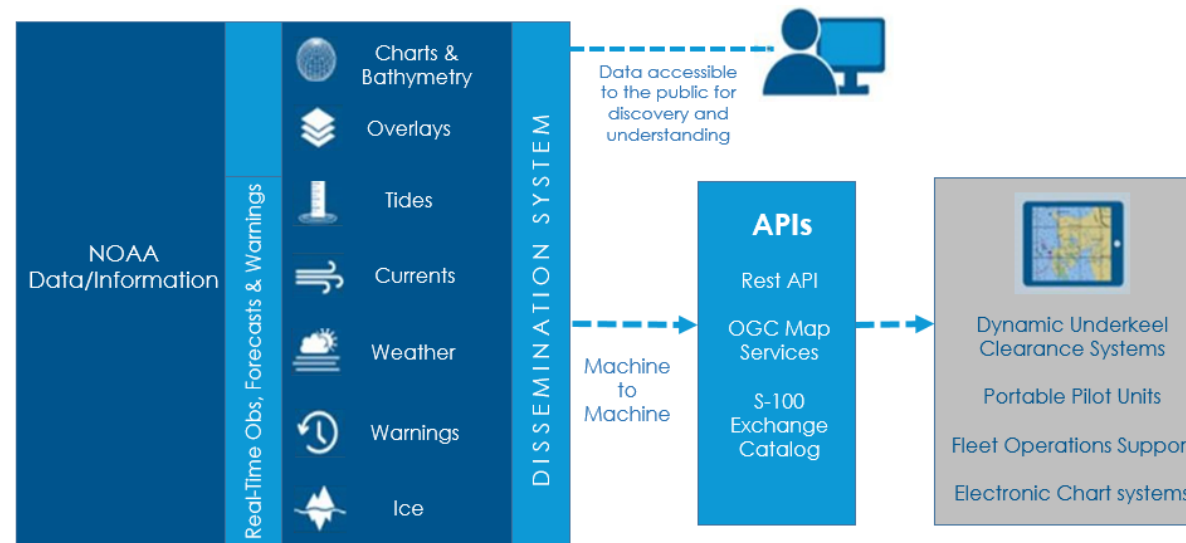
August 2019



# Five-Year Roadmap

## NOAA Precision Navigation Dissemination System

- NOS/OCS will create a high-reliability, centralized, cloud-based acquisition and dissemination system to provide a seamless coverage of interoperable hydrographic & bathymetric information along with meteorological & oceanographic observations & forecasts for U.S. coastal waters by 2022/2023
- The dissemination system will make the data & information available in standardized formats including the IHO Universal Hydrographic Data Model S-100 framework & other standards (e.g. Web APIs such as OGC protocols)





# Five-Year Roadmap

## NOAA Precision Navigation Dissemination System

- The dissemination system will make it easier for ECS and PPU manufacturers and under-keel-clearance software companies to ingest/process/display NOAA's marine navigation data and information to enable precision navigation at major U.S. seaports



*NOAA data –enabling precision navigation*



# FY20 Milestones

- **Develop a prototype of the Precision Navigation data dissemination system in a cloud environment**

## **Two Deliverables:**

- 1) **A initial version of the NOAA marine navigation web site, *marinenavigation.noaa.gov* with a section for Precision Navigation**
- 2) **A prototype dissemination system in a commercial cloud environment containing a limited set of NOAA marine navigation datasets in S-100 formats**



# FY20 Measurable Milestones

## NOAA marinenavigation.noaa.gov

**Purpose:** provide one site for commercial & recreational mariners to discover, find, and learn about the extensive amount of NOAA marine navigation information available to them.

**Milestone:** initial version of the NOAA marine navigation web site, *marinenavigation.noaa.gov* with a section for precision navigation (V0.5)



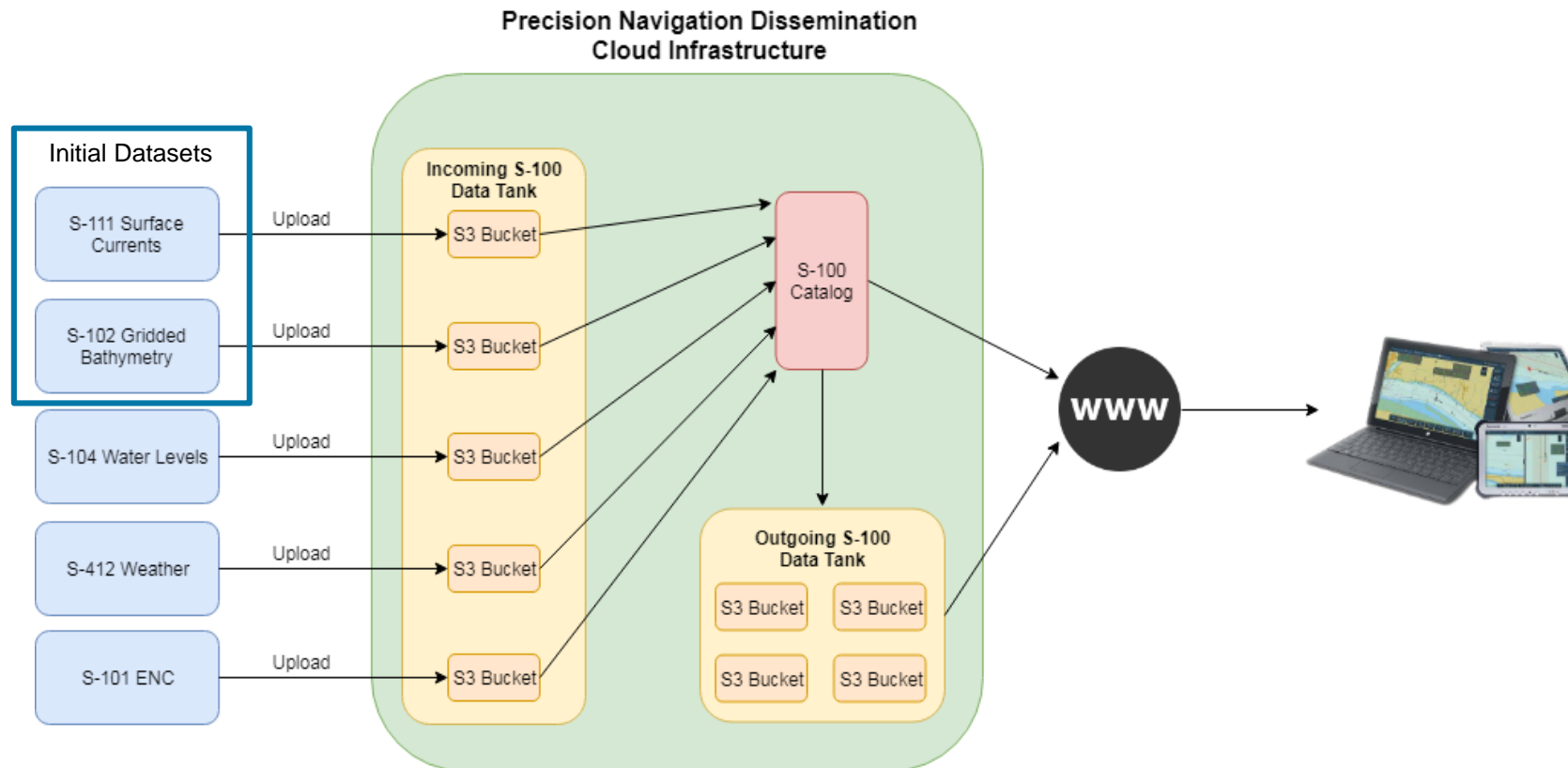


# FY20 Milestones (cont.)

## NOAA Precision Navigation Dissemination System

**Purpose:** provide one location for commercial and recreational mariners to obtain NOAA's S-100 Product Suite

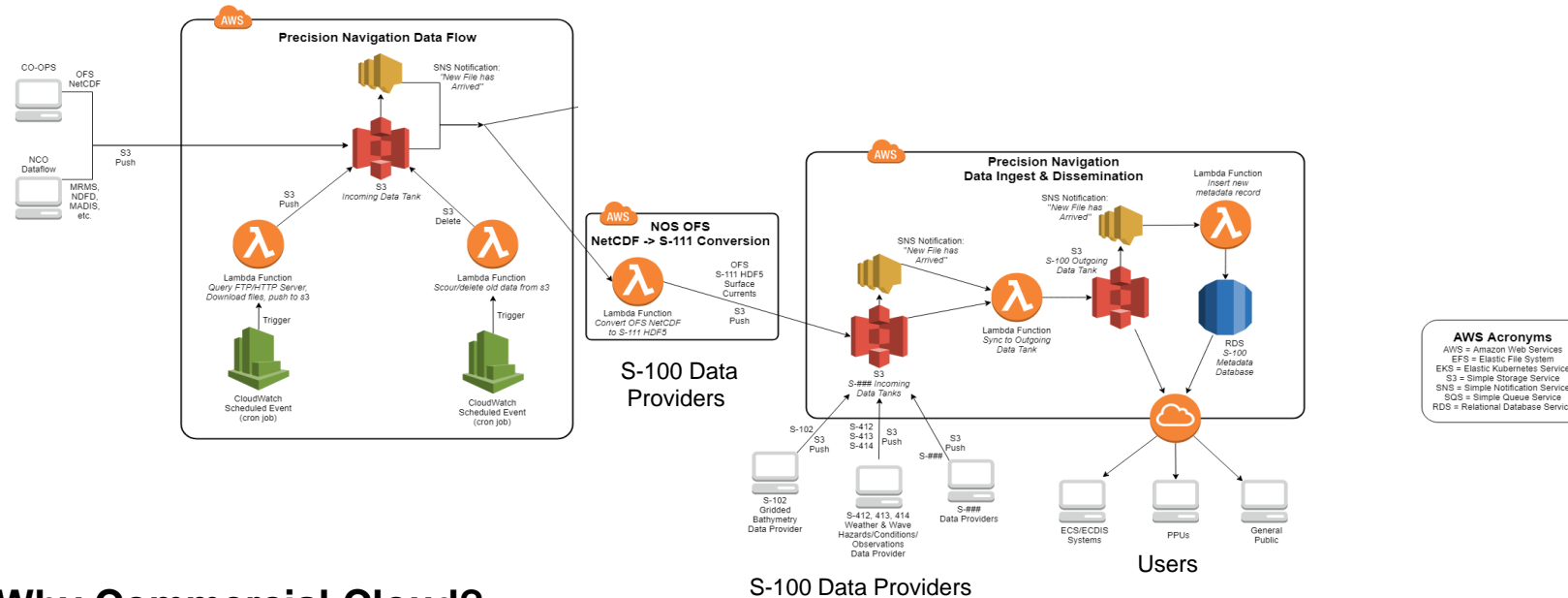
**Milestone:** Prototype PN Dissemination system in a commercial cloud environment to provide initially, a limited set of marine navigation datasets in S-100 formats





# FY20 Milestones (cont.)

## Initial Precision Navigation Cloud-Based Data Ingest, Processing, and Dissemination System



## Why Commercial Cloud?

- cloud-based **Platform-as-a-Service & infrastructure-as-a-Service** offerings allow for reduced overhead associated with maintaining operational hardware, virtual machine, operating system, and networking infrastructure (*especially impacted by difficulty in hiring IT personnel in the federal gov*)
- greater potential to implement new versions on a regular basis
- scalable - can rapidly respond to meet sudden surges in web traffic



# FY20 Milestones

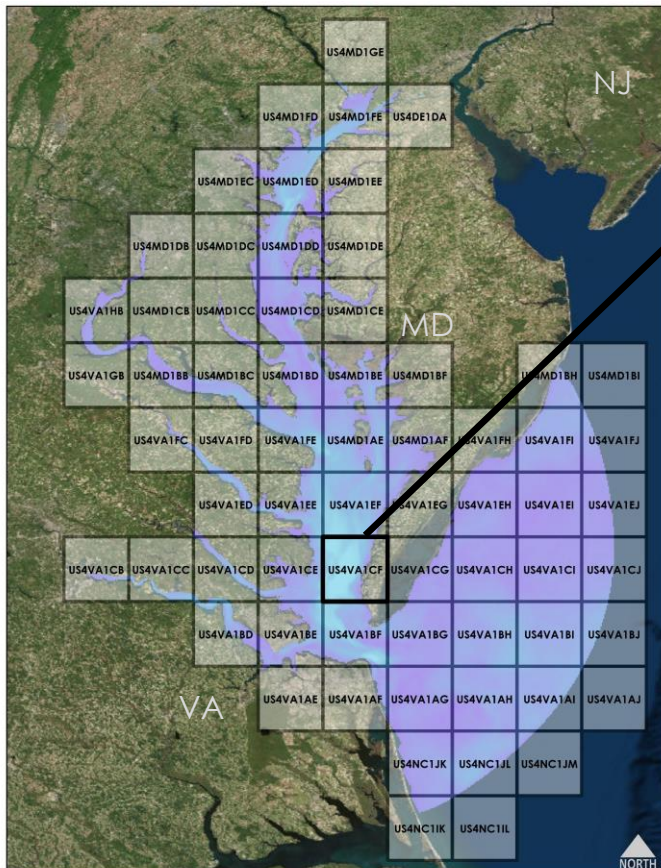
- **Initial S-100 Product Suite by end of FY20 Q2** (Mar. 2020)  
**available on Prototype PN Dissemination System:**
  - **S-111 Water Currents for several of the NOS operational oceanographic forecast modeling systems (OFS) and NWS/NCEP Global Real-Time Ocean Forecast System (GRTOFS)**
  - **S-102 Gridded Bathymetry ('skin of the Earth', no features)**
    - **New England Region**
- **Marine Navigation Web Site (Ver. 0.5)**
- **Prototype S-100 Exchange Catalog which includes metadata for S-111 datasets**



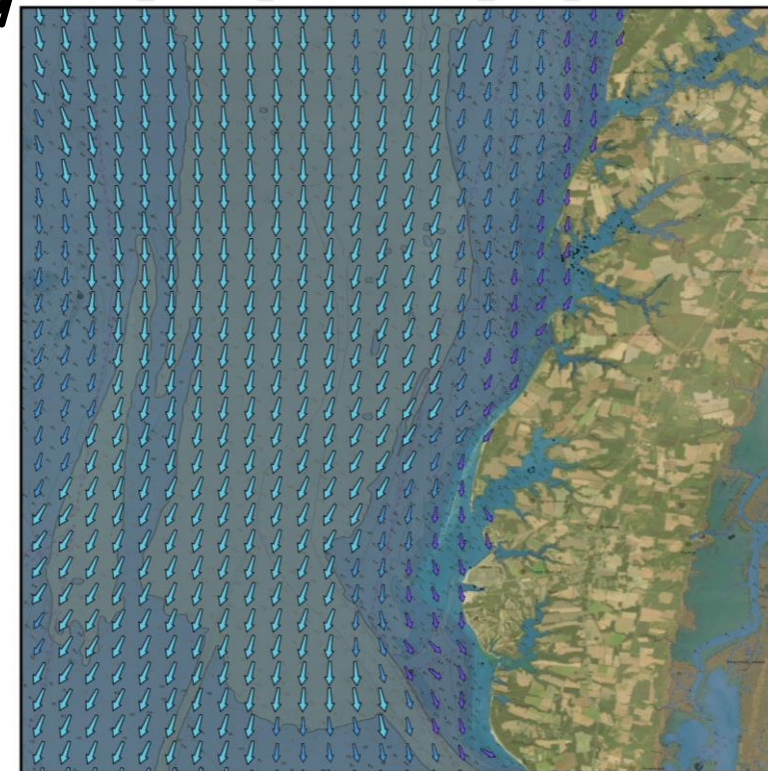
# FY20 Measurable Milestones (cont.)

For example:

- S-111 Water Currents Forecast Guidance from NOAA/National Ocean Service's Chesapeake Bay Operational Oceanographic Forecast Modeling System



S111US\_CBOFS\_20181203T00Z\_TYP2\_US4VA1CF.h5



Visualization of Surface Currents Forecast Guidance  
in part of the Chesapeake Bay OFS Domain

Disseminating 63 CBOFS S-111 Files 4x/Day



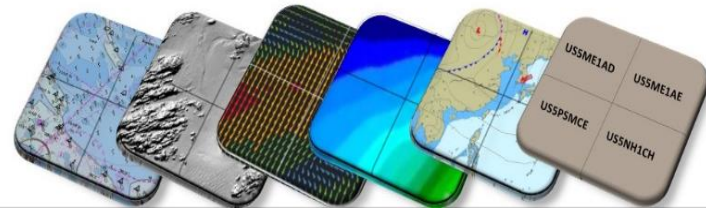
# Plans for FY21 to FY24



# FY21 Milestones

- Disseminate additional S-100 Production Suite formats
  - S-412 Weather and Wave Hazards Overlay

(From NWS/NCEP Ocean Prediction Center)



*Illustration of five S-100 Products:*

S-101 ENC, S-102 Bathymetry, S-111 Water Currents,  
S-104 Water Levels, S-412 Weather Overlays

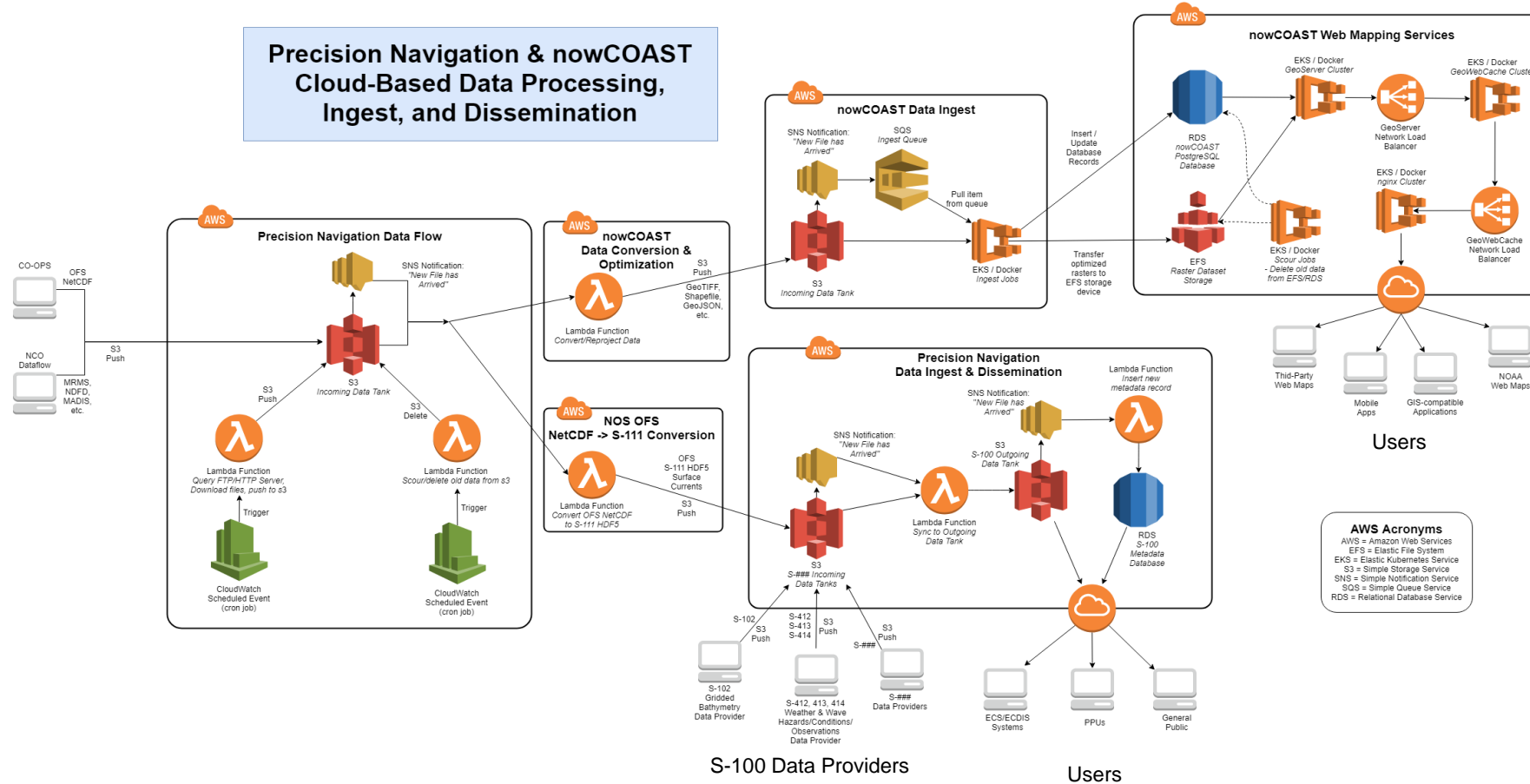
- High-Definition Chart for Priority Ports
- Prototype nowCOAST in the Cloud site\*

\* *Dependent on building out the PN/NC Dissemination Team*



# FY21 Milestones

## Prototype Cloud-Based Version of nowCOAST to provide additional NOAA datasets via a larger variety of Web mapping services

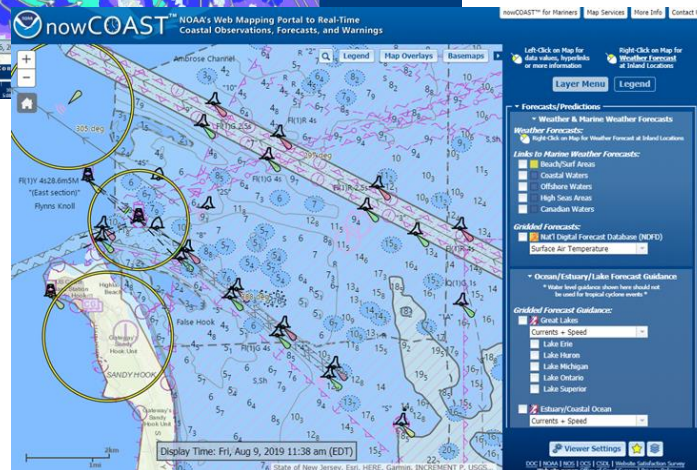
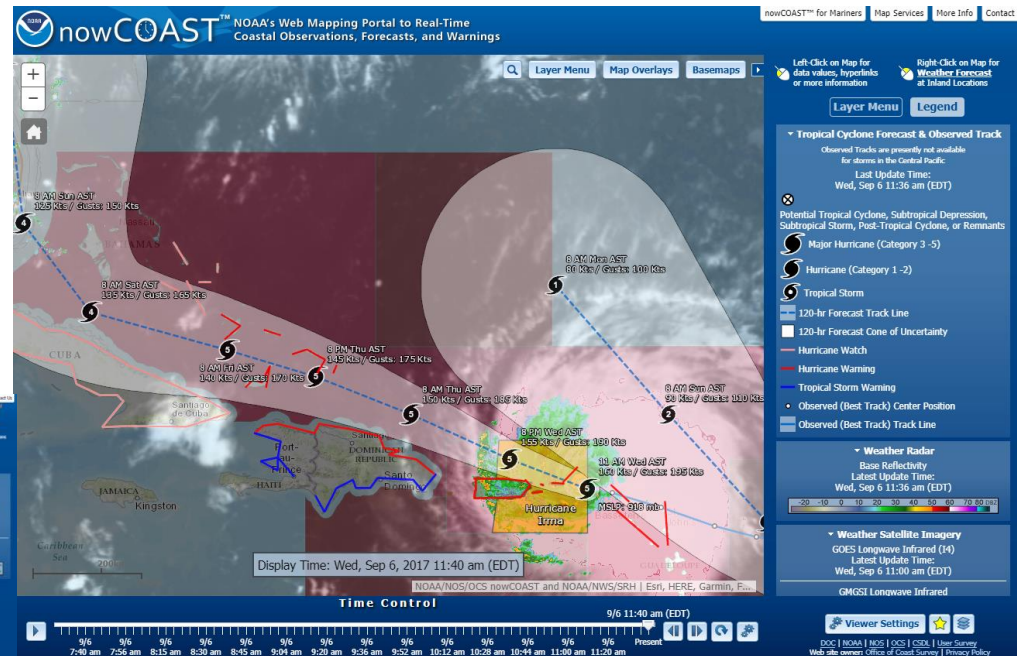
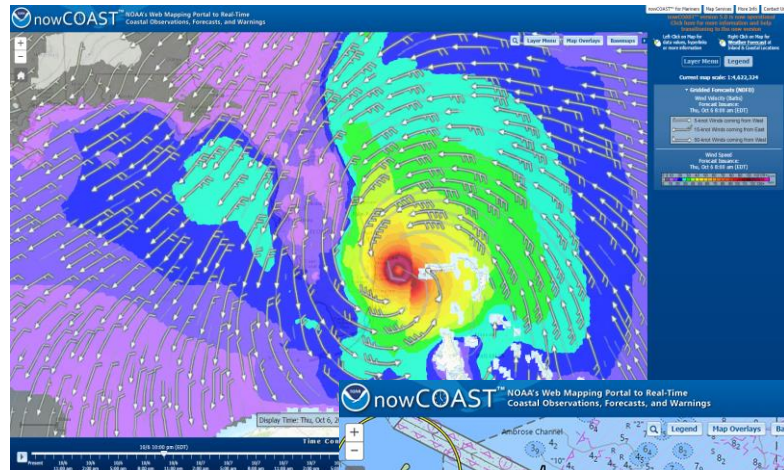




# NOAA/NOS nowCOAST Web Mapping Portal

NOAA's Flagship GIS Web Mapping Portal for observations, analyses, forecasts, model guidance, and watches/warnings/advisories

<https://nowcoast.noaa.gov>



Purpose:

- Provide users with situational awareness/coastal intelligence of recent past, present, and future environmental conditions for coastal U.S.

Users Include:

- Commercial/recreational mariners & fishermen, Emergency Managers, Coastal Managers, Search & Rescue & HAZMAT response, Risk Managers

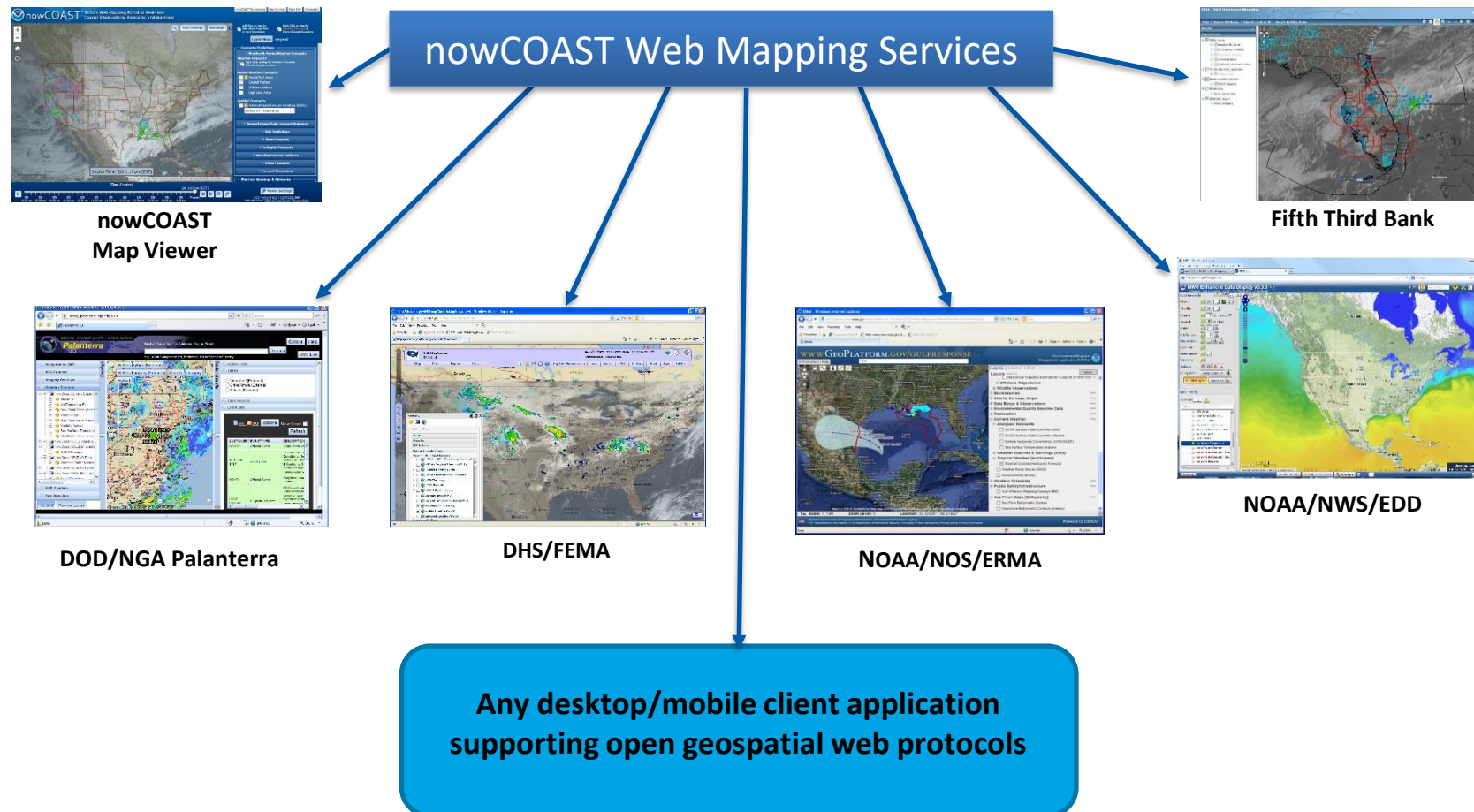


# NOAA/NOS nowCOAST Web Mapping Portal

## NOAA's nowCOAST Web Mapping Services

Standards-compliant web service access  
to raw data & visualizations

<https://nowcoast.noaa.gov>





# NOAA/NOS nowCOAST Web Mapping Portal

## NOAA's nowCOAST Web Mapping Services

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### Presently-supported web protocols:

- Open Geospatial Consortium (OGC) Web Map Service (WMS)
- GeoServices REST Map Services (ESRI ArcGIS Server REST)

### Potential future supported protocols from Cloud-Based nowCOAST

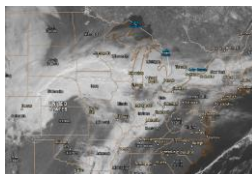
- OGC Web Map Tile Service (WMTS)
- OGC Web Feature Service (WFS)
- OGC Web Coverage Service (WCS)
- Mapbox Vector Tiles (MVT)
- Others as requested by users...

### Presently-provided layers include:

- NOS Operational Forecast System (OFS) surface currents, temperature, salinity
- NWS Real-Time Ocean Forecast System (RTOFS)
- NOAA Weather & Ocean Observations
- NWS NDFD Gridded Forecasts
- NWS Watches, Warnings Advisories
- NHC Tropical Cyclone Track & Intensity Forecasts
- NCEP Real-Time Global Sea Surface Temp. Analysis
- NWS Real-Time Mesoscale Analysis (RTMA)
- NESDIS GOES Satellite Cloud Imagery
- Many more...



Weather Radar



Cloud Imagery



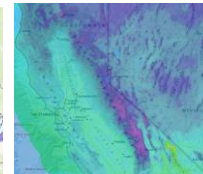
Rainfall Analyses



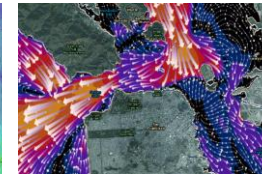
Outlooks



Watches/Warnings



Temp Forecast

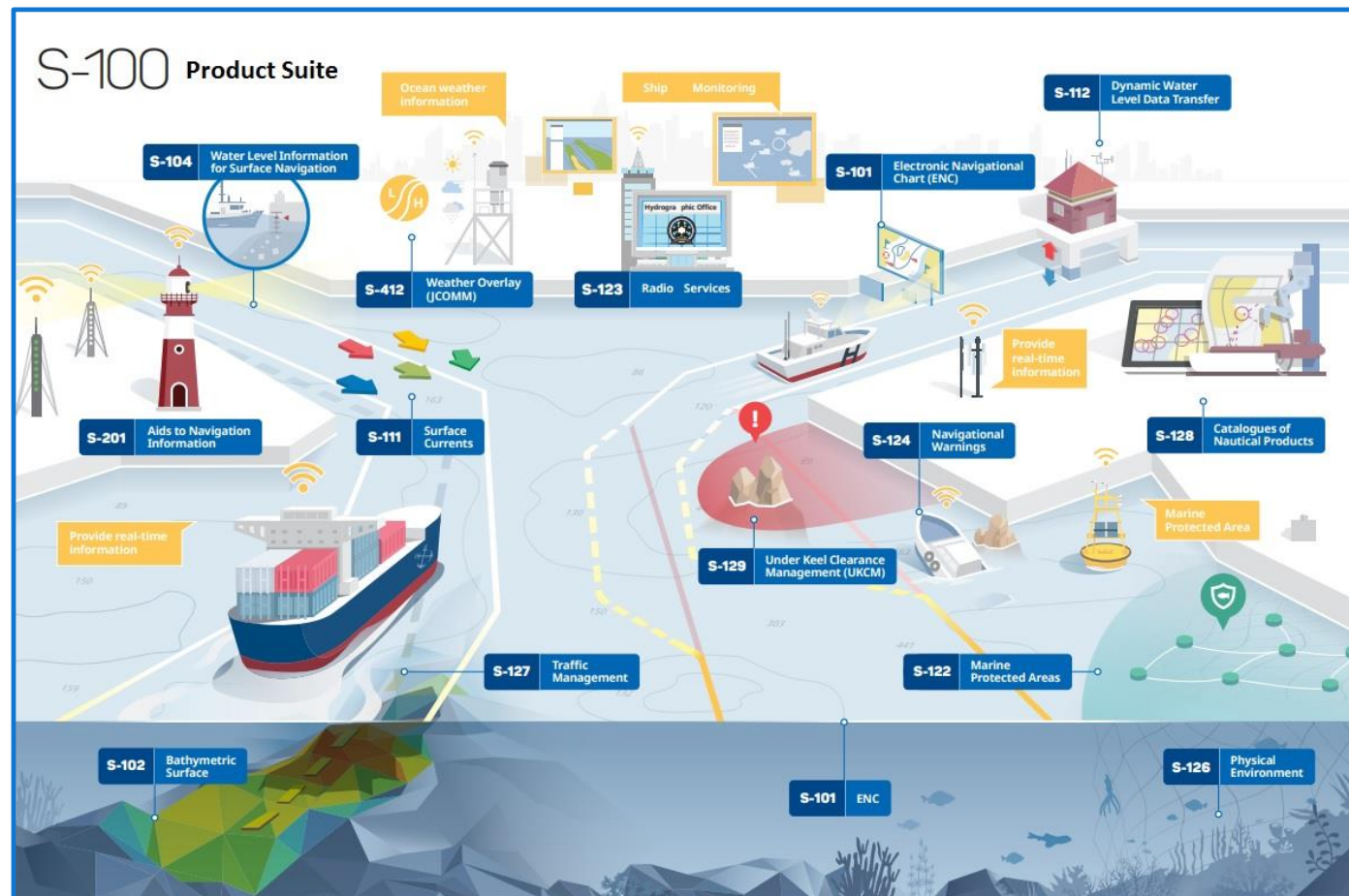


Model Guidance



# FY21-24 Milestones

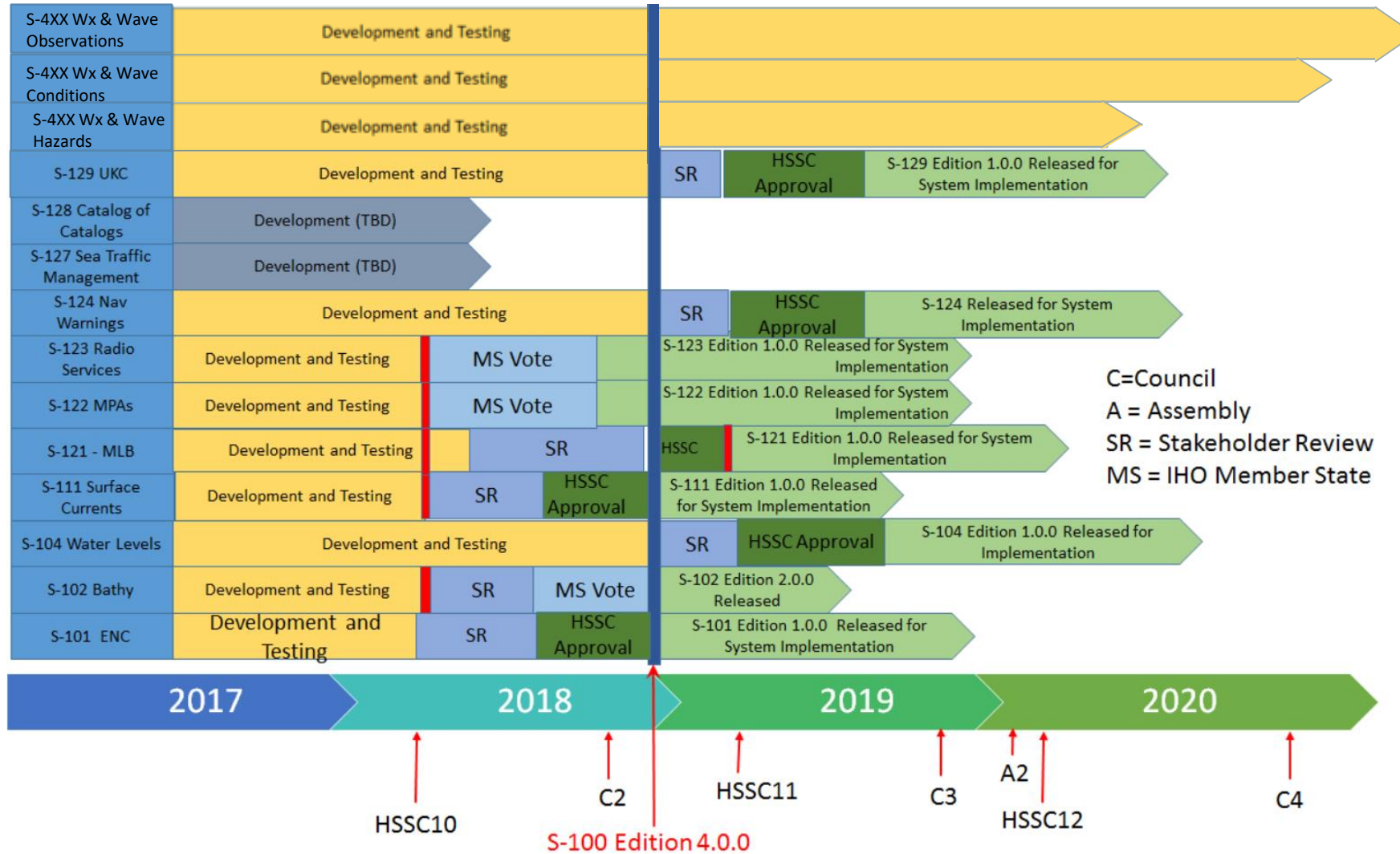
- Disseminate additional products from S-100 Product Suite as specifications and formats are approved & released and datasets encoded by NOAA





# Plans for FY21-FY23 Dependent on S-100 Product Specifications Development/Testing/Approval and Implementation by NOS and NWS

## Tentative Schedule for S-100 Product Suite





# FY22/23 Milestones\*

- **Precision Navigation Dissemination System becomes 24 x 7 operational site \*+**

*\*Dependent on building out the PN/NC Dissemination Team  
+ Meets NOAA IT Security Requirements*





# FY24 Milestones

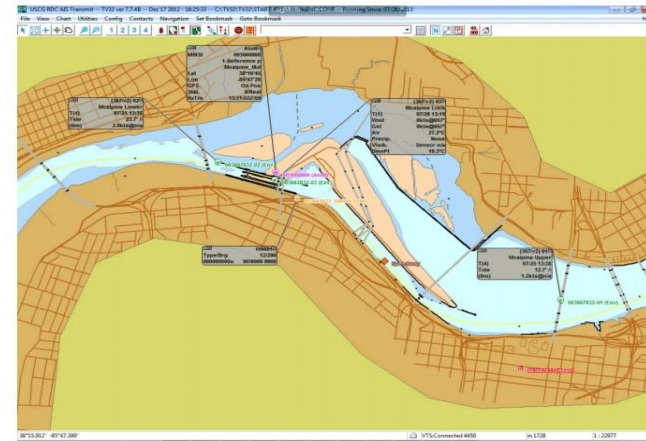
- **Disseminate additional S-100 Production Suite formats in coordination with NWS/NCEP Ocean Prediction Center**
  - S-413 Weather & Wave Conditions
  - S-414 Weather & Wave Observations

S-412	S-413	S-414
Wave and Weather Hazards	Wave and Weather Conditions	Wave and Weather Observations
Polygons	Features (e.g. fronts) Gridded Data	Point Based Data



# FY24 and Beyond

- Possibly disseminate additional datasets from the S-100 Product Suite in coordination with other federal agencies (e.g. USACE)
- Possibly disseminate AIS Supplemental Binary Messages of weather & oceanographic obs from NDBC, NWLON, PORTS, IOOS, and ASOS observing platforms, if USCG moves forward to provide capability to transmit
- Possibly expand PN Dissemination Web Site to include information about marine navigation available from other federal agencies (e.g. migrate to *marinenavigation.gov*)

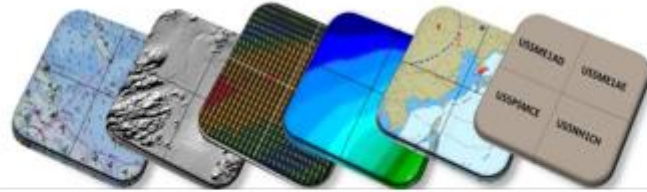


Source: <http://www.dtic.mil/dtic/tr/fulltext/u2/a622863.pdf>



# NOAA Precision Navigation Overview

## Questions and Answers Session



*Illustration of five S-100 Products:*  
S-101 ENC, S-102 Bathymetry, S-111 Water Currents,  
S-104 Water Levels, S-412 Weather Overlays

### Contact Information

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NOAA/National Ocean Service/Coast Survey Development Lab  
**Jason.Greenlaw@noaa.gov**

Capt. Liz Kretovic  
NOAA Precision Navigation Program Manager  
Deputy Hydrographer  
NOAA/National Ocean Service/Office of Coast Survey  
**Elizabeth.Kretovic@noaa.gov**

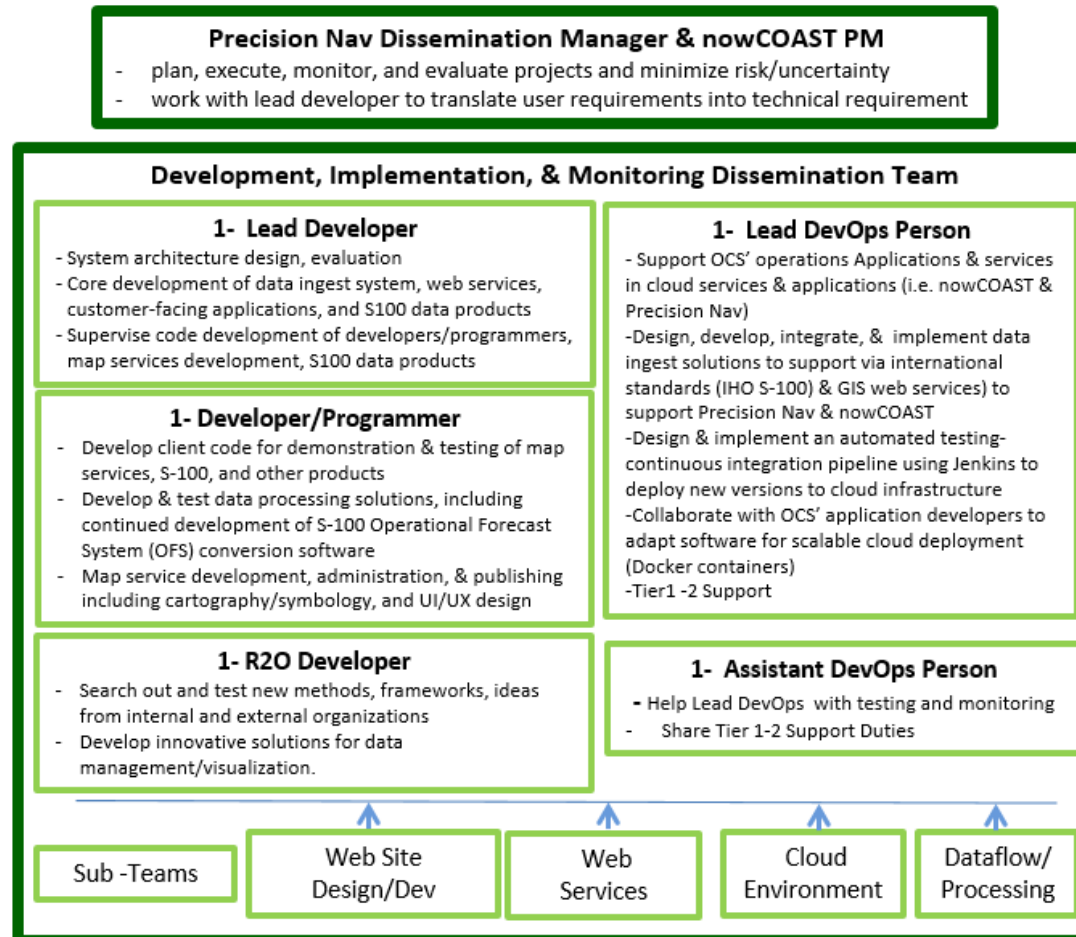


# Extra Slides



# Preliminary Concept of Operations

**NOS/OCS will be responsible for the development, operations and maintenance of the  
Precision Navigation Dissemination Site  
(and potentially nowCOAST) in Commercial Cloud Environment**



Present Manpower:

50% of Jason Greenlaw  
50% of Erin Nagel  
35% of John Kelley

100% of Adam Gibbons  
(Summer 2019 Intern)

OCS/IT Branch: Web Site  
Design/Dev/Deployment  
David Barglow & Saron Desta



# NOAA/NOS nowCOAST Web Mapping Portal

## nowCOAST Map Viewer

Interactive web mapping data visualization application

<https://nowcoast.noaa.gov>

